

VU Research Portal

Having belief(s) in social virtual worlds: A decomposed approach

Merikivi, J.; Verhagen, T.; Feldberg, J.F.M.

2010

document version

Early version, also known as pre-print

[Link to publication in VU Research Portal](#)

citation for published version (APA)

Merikivi, J., Verhagen, T., & Feldberg, J. F. M. (2010). *Having belief(s) in social virtual worlds: A decomposed approach*. (Research Memorandum; No. 2010-10). Faculty of Economics and Business Administration.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal ?

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

E-mail address:

vuresearchportal.ub@vu.nl

Having belief(s) in social virtual worlds: A decomposed approach

Research Memorandum 2010-10

**Jani Merikivi
Tibert Verhagen
Frans Feldberg**

Having belief(s) in social virtual worlds:

A decomposed approach

Jani Merikivi^a, Tibert Verhagen^b, Frans Feldberg^b

^aTurku School of Economics, Information Systems Science, Turku, Finland

^bVU University Amsterdam, Knowledge Information and Networks group, Amsterdam, The Netherlands

Abstract

The interest in teenager oriented social virtual worlds with multiple functions has mushroomed during the past few years. The key challenge social virtual worlds face while attempting to anchor and serve the masses is to reflect the core beliefs of their users. Existing research lacks insight into these core beliefs and their influences on social virtual world usage, as system-specific beliefs and the multipurpose nature of these systems have largely been left unaddressed. In this study we aim to contribute to the research of social virtual worlds by proposing and testing a model grounded on the decomposed theory of planned behavior (S. Taylor & Todd, 1995a). The model proposes system-specific attitudinal, normative and control beliefs as determinants of three actual behaviors, mediated by continual use intentions. The model is tested with data collected from 1,225 active users of Habbo Hotel, one of the most popular social virtual worlds in the industry. The results indicate significant though different influences of attitudinal and control beliefs. The most fundamental finding is the irrelevance of normative beliefs which puts the social nature of social virtual worlds into perspective.

Keywords: Social Virtual world, Decomposed Theory of Planned Behavior, Continual Use, Attitudinal Beliefs, Normative Beliefs, Control Beliefs, Overt behavior.

Introduction

Social virtual worlds (SVWs) such as Habbo Hotel, Club Penguin, Neopets, and Stardolls are attracting an enormous group of young people (kZero, 2009). Based on three-dimensional online gaming environments (Bainbridge, 2007; Bartle, 2003; Book, 2004), SVWs without having narrative goal structures offer their users the option of choosing from a multitude of popular ways in which to use these systems, such as social interaction, gaming, and collection/use of digital content (eMarketer, 2009). One of the most well known SVWs among teenagers is Habbo Hotel. This SVW provides a free access to over 30 country-specific portals with a number of public facilities such as virtual parks, and cafés, and millions of user-generated private virtual rooms. In Habbo Hotel, the young Habbo users are able to communicate with one another and play various non-violent online games. To express themselves the Habbo users may customize the way their avatars look, walk, talk, and dance, and purchase Habbo credits in order to create and furnish their very own personal virtual rooms. Not building on access fees but rather on commercials and voluntary premium services, Habbo Hotel has succeeded in achieving and maintaining a critical mass of teenagers who have started to translate their loyalty into monetary spending (Caoili, 2010).

Despite the growth of the industry, remarkably little is known about the beliefs that influence the usage of SVWs such as Habbo Hotel. An insight into the role of these behavioral beliefs is valuable, as it will help operators, designers and partners to further align the functionality of SVW systems to better accommodate the needs of their users. To explore the influence of key beliefs driving SVW usage behavior we propose and test an integrative model grounded on the decomposed theory of planned behavior (DTPB). This theory, elaborated on in the next section, was selected over other theoretical perspectives for two reasons. First, from a contextual perspective, it enables us to disaggregate rather generic behavioral beliefs into a set of beliefs that directly apply to SVWs. Such a decomposed

approach is openly called for given that previous research into the SVW usage has focused only on a few general technology adoption variables while substantially ignoring other important motivations affecting SVW usage (see Zhou, Jin, Vogel, Fang, & Chen, 2010). For the purpose of this study, conforming to DTPB, the beliefs will be decomposed into attitudinal, normative and control beliefs. Though attitudinal beliefs are rather generic in nature, we however include these to better address the multi-purpose nature of SVWs. The proposed combination with normative and control beliefs is rather unique as it specifically taps into the distinctive social and navigational characteristics of SVWs. In SVWs others constantly surround users which makes it assumable that the opinions of friends and relatives (normative beliefs) shape behavior. Comparably, the new navigational skills required to master the avatar-mediated interaction of SVWs lead to the expectation that beliefs about the controllability of the system (control beliefs) determine behavior. Second, from a theoretical perspective, usage of the DTPB is warranted by the fact that it is preferred over more parsimonious alternatives (e.g., theory of reasoned action, TRA; Fishbein & Ajzen, 1975; technology acceptance model, TAM; Davis, 1989; Davis, Bagozzi, & Warshaw, 1989) in situations where usage may be shaped by multiple purposes (e.g., socialize, gaming, buying content). In such situations there seems to be value in sacrificing simplicity to include a richer set of antecedents as it will result in a deeper reconstruction of reality (Christopher, John, & Vandenbosch, 2001). The gained knowledge may be used to develop in-depth insight into SVW usage and provide their operators and designers with more detailed guidelines of what to prioritize in system development.

The overarching goal of this paper is to develop a framework and examine the effects of key attitudinal, normative and control beliefs on SVW usage behavior. This goal translates into the following key question: How and to what extent do attitudinal, normative and control beliefs influence SVW usage behavior? By answering this question, this paper intends to

make three contributions. First, we generate a new insight into the key beliefs underlying SVW usage. Knowledge on this issue is scarce and demanded for (Jung & Kang, 2010). Second, drawing upon DTPB, we propose and test a mediating role of continual use intentions when relating beliefs to the overt behavior of the users of Habbo Hotel. Validating this structure classifies as a contextual extension. Third, we use real users of the SVW Habbo Hotel to test the proposed model. As most prior research on SVWs has made use of convenience sampling, using real users adds to the external validity of our findings.

Background: the decomposed theory of planned behavior

To focus explicitly on the conceptualized role of accessible beliefs behind SVW usage, this study expands upon the DTPB (Hsieh, Rai, & Keil, 2008; S. Taylor & Todd, 1995a). Unlike such models as TRA and TAM, the DTPB has the advantage that it is relatively well suited to analyzing more than only one behavior of interest. Such account would enhance development of knowledge in situations where technological innovations serve multiple extrinsic and intrinsic purposes, that is, in SVW settings.

Basically, the DTPB is a modification of the theory of planned behavior (TPB) (Ajzen, 1991). The TPB posits that an individual is driven by behavioral intentions where behavioral intentions which are a function of behavioral attitudes, subjective norms, and perceived behavioral control. Behavioral attitudes stand for a person's general feelings of favorableness or unfavorableness toward a behavior (Fishbein & Ajzen, 1975), whereas subjective norms address a "person's perception of the social pressures put on him to perform or not perform the behavior in question." (Ajzen & Fishbein, 1980, p. 6) Perceived behavioral control concerns "people's perception of the ease or difficulty of performing the behavior of interest." (Ajzen, 1991, p. 183) The TPB has been applied to various behavioral settings, including IT usage, and the overall results support the predictive and nomological value of attitudes,

subjective norms, and perceived behavioral in explaining intentions and overt behavior.

Although prior information system (IS) research has confirmed all TPB components to influence IT usage behavior in various domains, the discussion on the appropriate set of usage determinants has remained lively for the past two decades. For instance, Taylor and Todd (1995a; 1995b) highlighted the need for disaggregation of the three intention determinants to arrive at a fuller understanding of the beliefs underlying specific IT usage behavior. This indicates that finding the appropriate set of belief constructs does not necessarily require the adoption of generic constructs, rather it recommends decomposing behavioral attitudes, subjective norms and perceived behavioral control into belief structures that directly apply to the specific context of the research setting. From this perspective the terms attitudinal beliefs, normative beliefs and control beliefs are used, each of them referring to the particular concept they are decomposed from. Attitudinal beliefs are defined as an individual's subjective probability that performing the behavior of interest will lead to certain outcomes (Fishbein & Ajzen, 1975). Normative beliefs are an individual's perception about a particular behavior which is affected by the judgment of relevant others (i.e., referents). Control beliefs are defined as to how easy or difficult it will be for an individual to perform a behavior (Ajzen, 2005). The decomposition approach, founded on theoretical rationale, forms the crux of the DTPB. As such, it can be considered an adaptable yet congruous theoretical building block for uncovering the use of SVWs.

Research model and hypotheses

Figure 1 shows the research model proposed. Drawing upon DTPB, the backbone of the model was formed by continual use intention and actual behavior. Three types of actual behavior were selected that typically occur in SVWs: trading digital content, having social interaction, and engaging in SVW gaming activities. As Habbo Hotel was used to collect the

data, we further specified trading digital content into trading of digital furniture. Digital furniture is a type of content heavily traded by Habbo users (Habbo Hotel, 2008). In line with DTPB attitudinal, normative and control beliefs complete the model. Perceived enjoyment and perceived usefulness were included as attitudinal beliefs. Both are rooted into the well-known distinction between intrinsic (perceived enjoyment) and extrinsic (perceived usefulness) motivations to use a system. Given the multi-purpose nature of SVWs, this makes it very interesting to cross-validate their (relative) influence on behavior. Referents and perceived critical mass were proposed as normative beliefs. SVWs are social online environments, in which users are literally surrounded by other users. Such presence makes it plausible to assume that social pressures do influence behavior. Both proposed beliefs address the social pressures associated with using SVWs, either from a qualitative (referents) or quantitative (critical mass) view. Finally, perceived ease of use and self-efficacy were included as typical control beliefs. These particular beliefs seem closely associated with new navigational skills required to use the system via avatars, which are not demanded for when using more traditional ISs such as websites. This makes it highly likely that both influence behavior in SVW settings. A more detailed discussion on these beliefs, including their definition and conceptualization, is provided in the next sections.

Following Premkumar et al. (2008) we decided to directly relate the different beliefs to the continual use intention. Such approach differs slightly from more traditional DTPB modeling as it removes the attitude, subjective norms and perceived behavioral control as mediating higher-order factors between the decomposed beliefs and the continual use intention. This more direct approach has a clear advantage in that it tests the role of beliefs as second-order determinants of the actual behavior instead of third-order factors. From a managerial perspective, this implies that our findings translate more directly into action as the beliefs are likely to account for a substantial part of the actual behavior variance. From a

theoretical perspective, this more direct approach is advocated by Stutzman and Green (1982) who noted that the traditional relationship beliefs → attitude/subjective norms → intention → behavior is appropriate for simple behaviors, analogous to a single act criterion. For multiple act criteria and more complex behaviors, however, one needs to take a more complex view of the model by linking variables more directly to behavior. Support for this view is provided by literature that found rather direct effects of beliefs on various forms of behavior (Bagozzi, 1981; Bentler & Speckart, 1979; Fisher, 1984; Kantola, Syme, & Campbell, 1982).

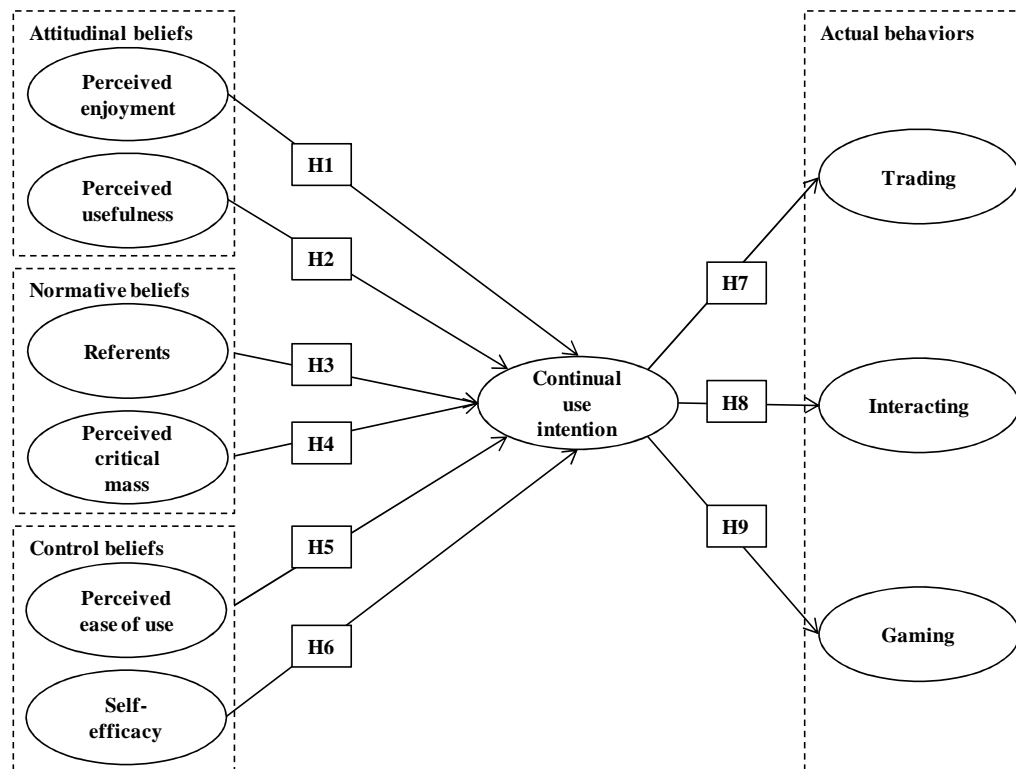


Figure 1 Research model

The influence of attitudinal beliefs on continual use intentions

Attitudinal beliefs in IS research have predominantly been regulated by two types of beliefs, namely extrinsic and intrinsic (e.g., van der Heijden, 2004; Venkatesh & Brown, 2001).

Extrinsic motivation propels individuals to achieve a specific outcome (e.g., reward,

recognition), whereas intrinsic motivation drives them to engage in activities for their own sake (e.g., pleasure, joy, or satisfaction) (Deci & Ryan, 2000). Following prior IS literature (e.g., Davis, Bagozzi, & Warshaw, 1992; Hsieh et al., 2008), attitudinal beliefs are decomposed into the intrinsic belief perceived enjoyment and the extrinsic belief perceived usefulness. Both elements directly apply to SVWs given the combination of instantaneous pleasure and more instrumental values these systems provide.

Perceived enjoyment

Perceived enjoyment has widely been addressed in IS usage research (e.g., Moon & Kim, 2001; Teo, Lim, & Lai, 1999; van der Heijden, 2004), where it has been defined as the extent to which using the system is “perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated.” (Davis et al., 1992, p. 1113). As a number of consumer and game studies (e.g., Csíkszentmihályi, 1975; Holbrook, Chestnut, Terence, & Greenleaf, 1984; Huizinga, 1955; Malone, 1981) suggest, perceived enjoyment is regarded as the chief constituent of play. The accumulated literature suggests that perceived enjoyment may apply directly to SVWs since motivation to use these systems arises from play and enjoyment (Ryan, Rigby, & Brzybylski, 2006). As a result, we follow van der Heijden (2003) and propose that perceived enjoyment directly influences the continual use of SVWs.

H1: Perceived enjoyment positively influences the continual use intention.

Perceived usefulness

Following the intrinsic-extrinsic paradigm (Deci & Ryan, 2000) IS usage might not only be driven by perceived enjoyment but also perceived usefulness. Perceived usefulness is defined here as the degree to which a system is perceived to provide certain benefits when performing certain tasks (Davis, 1989; Hong, Thong, & Tam, 2006). Within the context of socially

oriented systems, performing such tasks underlines the instrumental value in that it promotes effective communication and interaction with other people as a way to spend time rather than to complete work-related tasks (see also Li, Chua, & Lu, 2005). The fulfillment of these social needs is a basic need that drives people to use SVWs (Jung & Kang, 2010; Zhou et al., 2010). Another element of the usefulness of SVWs is that they offer their users a new medium to express their identity and uniqueness. Individuals explore their identities with and within SVWs (T. L. Taylor, 2006) and differentiate themselves from others through consumption of virtual items (Lehdonvirta, 2009; see also Ruvio, 2008; Snyder & Fromkin, 1977; Tian, 2001). They may even exploit the opportunity to use avatars to communicate in an appearance different from their offline appearance, expressing themselves in a way others may find provoking, and transcending perceived offline social norms (Vasalou, Joinson, Bänziger, Goldie, & Pitt, 2008). Given the above, it is safe to assume that the overall instrumental value of an SVW contributes to a user's willingness to use an SVW. As a result, we hypothesize that:

H2: Perceived usefulness positively influences the continual use intention.

The influence of normative beliefs on continual use intentions

To decompose normative beliefs we follow Taylor and Todd (1995a; 1995b) and use innovation diffusion theory (IDT) (Rogers, 2003) as a theoretical starting point. According to IDT initial users of a new form of technology gather information about the advantages and disadvantages of this technology through the opinions of individuals, informal groups, organizations and other social subsystems. By making use of such social networks, which results in information perceived relevant to the user both in terms of quality and quantity, users' behavioral intentions to use the technology are shaped (Rogers, 2003). To deal with the qualitative and quantitative aspects of the SVW we decompose normative beliefs into

referents (Ajzen, 2005; Karahanna, Straub, & Chervany, 1999), and perceived critical mass (Lou, Luo, & Strong, 2000; Valente, 1995) respectively. These two elements are of particular interest from a normative online social system perspective since they reflect social pressure exerted by peers to use a system to strengthen existing social relationships or to add to and benefit from the network externalities of a system (Matei & Ball-Rokeach, 2001).

Referents

In order to assess the uncertainties associated with the adoption of a new form of technology (Katz, 1980) an individual collects information from his/her referents. Referents are key members in a personal network, consisting of family, friends and relatives (Ajzen, 2005). Referents are assumed to provide information of highly personal value to the individual (Childers & Rao, 1992). Being accompanied by a certain level of social expectations, SVW related information provided by referents is likely to influence an individual's behavioral intentions towards using innovative IS (Webster & Trevino, 1995). The idea behind this is that it taps the causal mechanism of individual's perception on social pressure: If referents think the individual should perform a particular behavior the more likely it is that he/she will act accordingly (see also Triandis, 1979). This logic, combined with the knowledge that social expectations are assumed to play an explicit role in the use of online social systems (e.g., SVWs) (Dholakia, Bagozzi, & Pearo, 2004), leads us to propose that:

H3: Referents positively influences the continual use intention.

Perceived critical mass

While the concept of referents captures the qualitative aspect of social influence, it ignores the quantitative side highlighted by perceived network exposure, meaning that an individual is more likely to engage in using a specific IT artifact the more members there are in his/her personal network already using it. In the IS literature, this phenomenon is known as critical

mass, which is defined as the point at which a further rate of adoption of an innovation becomes self-sustaining (Markus, 1990; Markus, 1994; Rogers, 2003). Given that it would be difficult to accurately determine the level of the actual critical mass (Craig, Ilie, Lou, & Stafford, 2007), we follow Lou et al. (2000) who address the importance of subjective perceptions of critical mass. Perceived critical mass relates to the extent to which an individual perceives most of the members in his/her network are using a certain innovation (Lou et al., 2000). In line with research on perceived network exposure (Hsieh et al., 2008; Li et al., 2005), it is plausible to assume that a higher perceived critical mass contributes to an individual's intention to continue using the technology. Such direct relationship is most likely to occur when considering systems, the use of which is subject to social pressures (Strader, Ramaswami, & Houle, 2007), a situation that clearly applies to SVWs. As a result, we expect that:

H4: Perceived critical mass positively influences the continual use intention.

The influence of control beliefs on continual use intentions

In line with the original DTPB we draw upon social cognitive theory (SCT) (Bandura, 1986) to embed and decompose perceived behavioral control into its underlying control beliefs. Basically, SCT posits a triadic reciprocal relationship between behavior, personal factors, and the environment. In other words, an individual's behavior both influences and is influenced by personal factors and the environment. Such presumption of an individual having the ability to influence his/her behavior, while at the same time recognizing that his/her behavior is influenced by personal factors and the environment, is consistent with that of perceived behavioral control which concerns personal perceptions of an individual's ability to perform a given behavior (Ajzen, 2002). From this perspective, and drawing upon previous empirical evidence (e.g., Hsieh et al., 2008)) we decompose perceived behavioral control into perceived ease of use (Davis et al., 1989; Davis, 1989; Hsieh et al., 2008) and self-efficacy (Agarwal,

Sambamurthy, & Ralph, 2000; Bandura, 1977; Compeau & Higgins, 1995). The perceived ease by which an individual is capable (personal factor) to use an SVW via an avatar differs from more traditional stand-alone interfaces, and the constant presence of other users (the environment) exerts pressure on the self-confidence to perform any behavior successfully. Therefore, both control beliefs seem of particular interest in SVW settings.

Perceived ease of use

Perceived ease of use is defined here as the degree to which a person believes he/she can use a system free of effort (Davis, 1989). Perceived ease of use deals with one of the most fundamental constructs determining IS use in various settings (Hong et al., 2006), and has been acknowledged to directly influence behavioral intentions (Davis, 1989). In SVW settings the concept demands for renewed attention as the usage of an avatar is a relatively new way of computer-mediated navigation, which demands new skills to control the system. Although initially treated as an attitudinal belief in the original DTPB, we position the concept as a control belief as it mirrors an individual's capability to handle the complexity of the control of a system. This decision is supported by earlier studies (Ajzen & Madden, 1986; Ajzen, 2005), stating that the perceived difficulty or ease in performing a behavior is indeed a salient feature related to perceived behavioral control. Given the accumulating empirical evidence it is conceivable to assume that the ease with which an individual is able to use an avatar and interact with and within an SVW is essential in developing a positive intention to continue using an SVW. Therefore, we postulate:

H5: Perceived ease of use positively influences the continual use intention.

Self-efficacy

Self-efficacy equals the degree of self-confidence an individual has about his/her capability to execute a behavior (Bandura, 1977). While the construct may be seen from a rather general

trait-oriented perspective, we adopt a more system-specific perspective (cf. Agarwal et al., 2000; Meng-Hsiang Hsu & Chao-Min Chiu, 2004). As such, it accounts for the varying effects of other users on the individual's ability to perform a particular behavior. The construct was originally introduced in the TPB in order to examine situations in which individuals may not be completely able to exercise control over the behavior of interest (Ajzen, 1991). The fact that users of SVWs are constantly observed by and confronted with others when performing a target behavior puts the concept of self-efficacy in a renewed perspective. Not only may the confrontation with other users' observations exert social pressure on their self-confidence to perform the behavior in question, but the users may even feel that it may be hampered by the actions of other users (e.g., losing a game because of other users' actions; being unable to purchase digital furniture as others already have them; being unable to socialize with another user as he/she is already connected to other users). These social characteristics make it plausible to believe that self-efficacy influences behavioral intentions in SVW settings. Moreover, in prior research there is a relative consensus that the higher the level of self-efficacy an individual has towards performing a certain behavior, the more likely it is that he/she intends to engage in it (Graham & Beverley, 2002). The above justifications and empirical support lead us to propose that:

H6: Self-efficacy positively influences the continual use intention.

Relating continual use intentions to actual behaviors

To further test the nomological validity of the six beliefs above, positive influences of continual use intentions on actual behavior complete the model. This structure corroborates to DTPB and has also been validated empirically in numerous replications of models such as TRA, TPB and TAM. In line with the multi-purpose nature of SVWs the following types of actual behavior are proposed as dependents: trading virtual property, having social interaction, and playing in-world games. As referred to in the above, these three forms of

behavior have been identified as the primary reasons for using the Habbo Hotel SVW (Habbo Hotel, 2008). Thus, we hypothesize:

H7: The continual use intention positively influences the actual willingness to trade in virtual furniture.

H8: The continual use intention positively influences social interaction in SVWs.

H9: The continual use intention positively influences the actual willingness to play in-world games.

Method and results

Research design and measures

A survey design was adopted to collect empirical data and test the hypotheses. The sample consisted of users of the Finnish portal of the SVW Habbo Hotel. With 162 million registered users worldwide, Habbo Hotel is one of the world's most popular teenager oriented SVWs. The survey was published on the home page of the portal; participation involved clicking on a hyperlink leading to an online survey. As no incentive of any kind was offered, the survey was completely voluntary and the probability of conditioning due to a participation bias was considered low (Toh & Hu, 1996). Except for the actual behaviors all measures were derived from established and validated measurement scales. The measures for the actual behaviors (trading furniture; socializing, playing in-world games) were grounded on empirical Habbo user studies (Habbo Hotel, 2006; Habbo Hotel, 2008). Some of the wordings of the measures were slightly adjusted to make them more applicable to our research context (see Appendix 1) Before publishing the survey, a pilot test was conducted using over two thousand Canadian Habbo users who were asked to evaluate the linguistic intelligibility of the survey and to propose improvements. The survey contained a set of socio-demographical questions

followed by a portion of worded items on a 7-point Likert-scale anchoring from strongly disagree to strongly agree. Bearing in mind that the respondents were teenagers, no identifiable personal information such as user names was collected. Therefore, parental approval was considered nonessential. Then, the survey was translated into the language in which it was to be administered (i.e., Finnish) by two IS researchers, whose native language is Finnish. The survey was then double-checked by a professional translator.

Results

Sample

A total of 2175 respondents filled out the survey completely. Majority of the respondents were female ($n=1289$; 59.3%), and between 10 and 15 years old ($n=1836$; 84.4%). 833 (38.3%) respondents reported to using Habbo Hotel between 1 and 3 years, while 934 (42.9%) respondents indicated using Habbo for 3 years or more. This implies that our sample was biased towards young, mostly female, rather experienced Habbo Hotel users. To investigate whether non-response bias posed a threat to the internal validity of the study, we compared the sample demographics with those of the population of Finnish Habbo users (cf. Pavlou, Huigang, & Yajiong, 2007). A comparison with available user surveys (Habbo Hotel, 2006; Habbo Hotel, 2008) indicated no large demographical discrepancies. This suggests that non-response bias was not a major concern in this study.

Test of measurement model

PLS was used to assess the validity and reliability of the measures¹. We utilized the software package Smart PLS (Ringle, Wende, & Will, 2005) to compute factor loadings, Cronbach's

¹ We initially planned to use structural equation modeling (SEM) to assess both measurement and structural model. First analyses resulted in poor fit. In such situations PLS can be seen as feasible alternative for SEM as it places fewer demands on normality of data distributions and residual distributions (Fornell & Bookstein, 1982).

alpha, composite reliability and Average Variance Extracted (AVE). The results indicated convergent validity of all measures as the factor loadings exceeded the 0.70 criterion (Agarwal & Karahanna, 2000), the alphas surpassed the 0.80 level (Ping, 2004), the composite reliability scores exceeded the recommended level of 0.707 (Nunnally, 1978), and the AVE-scores surpassed the recommended level of 0.50 (Fornell & Larcker, 1981).

Table 1 Validity and reliability statistics

Construct (no. of items)	Factor loadings	Cronbach's alpha	Composite reliability	AVE
Perceived enjoyment (3)	0.924; 0.950; 0.950	0.936	0.959	0.886
Perceived Usefulness (4)	0.892; 0.866; 0.852; 0.890	0.898	0.929	0.766
Referents (3)	0.919; 0.930; 0.881	0.898	0.936	0.829
Perceived Critical Mass (3)	0.886; 0.906; 0.867	0.865	0.917	0.786
Perceived Ease of Use (4)	0.924; 0.939; 0.907; 0.889	0.935	0.954	0.837

Self-efficacy (3)	0.939; 0.948; 0.944	0.938	0.961	0.890
Continual intention (3)	0.927; 0.951; 0.939	0.933	0.957	0.882
Trade virtual property (3)	0.866; 0.895; 0.920	0.875	0.923	0.799
Have social interaction (3)	0.834; 0.877; 0.890	0.835	0.901	0.752
Play in-world games (3)	0.778; 0.899; 0.899	0.825	0.895	0.740

Next, we assessed the discriminant validity of the measures by studying the within-construct item loadings and comparing these to across-construct item loadings. Since all within-construct item loadings were high, and substantially lower than their cross-loadings, discriminant validity could be assumed. Supplementary support for discriminant validity was provided by a study of the squared correlations between the constructs and a comparison of these scores with the individual AVEs (Table 2). For each pair, both individual AVEs exceeded the value of the squared correlations, confirming discriminant validity.

Finally, we assessed the reliability of the scales. The results strongly confirmed the reliability of the measures. All Cronbach's alphas and composite reliability scores exceeded the advocated values of 0.80. Moreover, all AVEs surpassed the 0.50 guideline for reliability (Ping, 2004).

Table 2 Squared pairwise correlation

Construct	PENJ	PU	REF	PCM	PEOU	SE	INT	TRA	SOC	GAM
Perceived enjoyment	0.886									
Perceived usefulness	0.848	0.766								
Referents	0.469	0.515	0.829							
Perceived critical mass	0.448	0.508	0.673	0.786						
Perceived ease of use	0.543	0.528	0.252	0.306	0.837					
Self-efficacy	0.375	0.352	0.141	0.199	0.723	0.890				
Continual use intention	0.669	0.639	0.360	0.398	0.583	0.494	0.882			
Trade virtual property	0.420	0.416	0.357	0.386	0.261	0.160	0.333	0.799		
Have social interaction	0.494	0.520	0.238	0.269	0.423	0.355	0.392	0.330	0.752	
Play in-world games	0.570	0.595	0.417	0.460	0.370	0.200	0.423	0.559	0.526	0.740

Note. The bold scores (diagonal) are the AVEs of the individual constructs. Off-diagonal scores are the squared correlations between the constructs.

Structural model

PLS modeling was applied to validate the structural model and test the hypotheses. Given our focus on predicting and attributing variances to the continual use intention and the actual

behaviors without having too much knowledge on the possible outcome structures derived from previous publications, PLS was deemed a feasible method (Fornell & Bookstein, 1982). We applied the bootstrapping technique (500 re-samples) to estimate the standardized path coefficients and explained variances. Two-tailed t-tests were conducted to assess the significance of the path effects. Overall, the results strongly confirm the predictive power of the model. The amount of variance explained was rather high, implying a good fit to the data. Except for hypothesis 3, all hypotheses were supported.

Table 3 Summary of the hypotheses testing results

Hyp.	Path	β	T-Statistics	Sign.	Result
1	Perceived enjoyment → continual use intention	0.35	9.315	< .001	Supported
2	Perceived usefulness → continual use intention	0.16	4.353	< .001	Supported
3	Referents → continual use intention	0.02	0.124	N.S.	Rejected
4	Perceived critical mass → continual use intention	0.08	3.530	< .001	Supported
5	Perceived ease of use → continual use intention	0.16	5.095	< .001	Supported
6	Self-efficacy → continual use intention	0.18	6.611	< .001	Supported
7	Continual use intention → trading virtual property	0.33	16.335	< .001	Supported
8	Continual use intention → have social interaction	0.39	15.950	< .001	Supported
9	Continual use intention → play in-world games	0.42	20.698	< .001	Supported

Note. All expected relationships are positive in nature; N.S. refers to non-significant

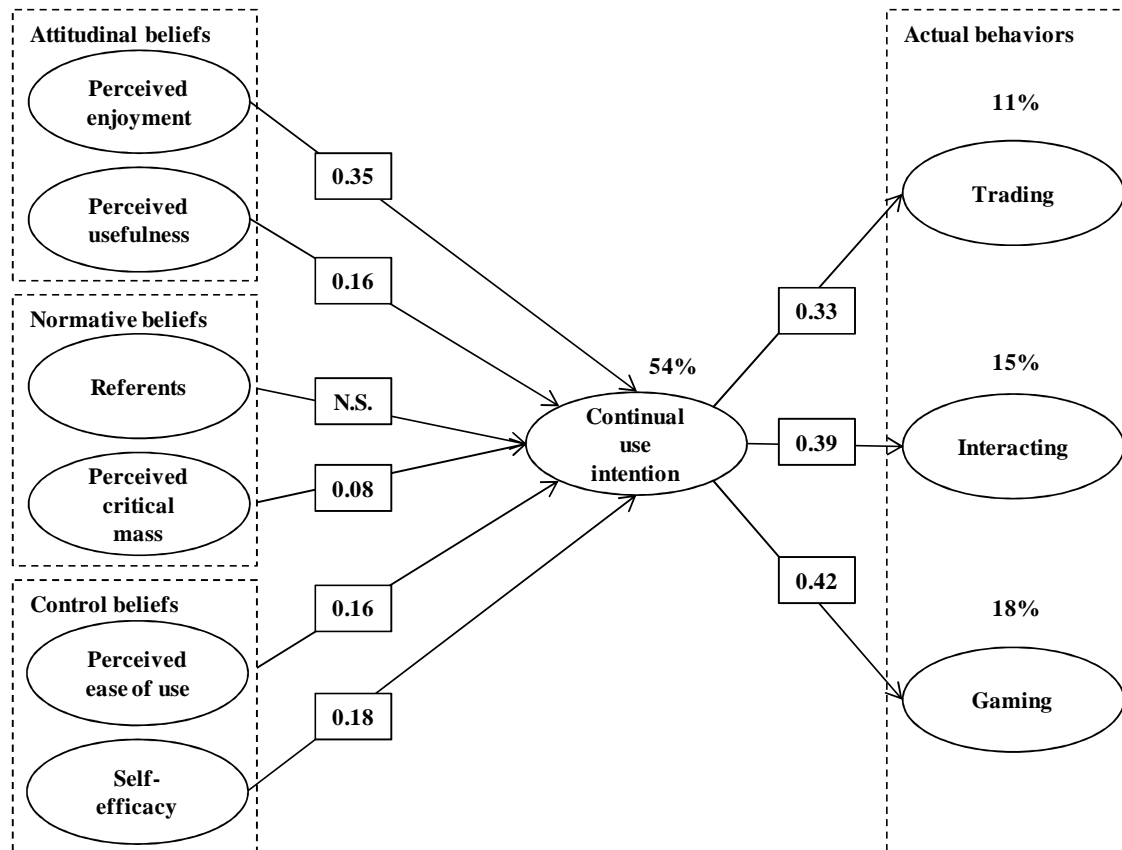


Figure 2 Structural model of the study

Discussion and conclusion

Key Findings

Together the beliefs in the research model explained 54 percent of the variance in the continual use intention, which is quite impressive. The intention was determined strongly by enjoyment ($\beta = 0.35$), rather moderately by self-efficacy ($\beta = 0.18$), ease of use and usefulness (both: $\beta = 0.16$), while a very small effect was noticed for referents ($\beta = 0.08$). Obviously, teenager oriented SVWs are likely to attract youths who perceive the system to deliver enjoyment and usefulness while reinforcing the feeling of being in control. These findings corroborate to previous findings on the adoption of online systems for social (e.g., Kim, Song, & Jones, 2010), gaming (e.g., Ryan et al., 2006) and transaction purposes (e.g., K. Lee, Tsai,

& Lanting, 2010) and underline the value of both ‘what’ and ‘how’ when designing SVW systems. A relatively high impact of enjoyment was observed, which adds to the notion that SVWs have a game-like, rather pleasure-oriented nature.

Remarkably, the influence of referents on the continual use intention was very low, while critical mass did not have a significant effect at all. These results suggest that normative beliefs, both from a qualitative and quantitative perspective, hardly lead to continual SVW usage intentions and thus to overt behavior. This finding feels rather counterintuitive given the social character of these systems. One would expect that youths in particular adjust their behavior to their referents’ views (Youniss & Smollar, 1985). A possible explanation for this unexpected finding comes from prior research into adolescent behavior. It is well known that while in their teens, youngsters aim for individual freedom and consumer autonomy. This need to be autonomous is seen as a universal need all humans share and is usually accompanied with the wish to make decisions on one’s own (Palan, Gentina, & Muratore, 2010). Still, youngsters may share opinions with friends and relatives, but this is mainly done for social purposes and their input is unlikely to be utilized for consumer decision-making (Paterson, field, & Pryor, 1994). Such lack of effects is most likely to occur in situations where the decisions to be made are simple in nature and not accompanied by financial consequences (Palan et al., 2010; Paterson et al., 1994). Both elements directly apply to the SVW under examination, which is likely to substantiate why no effects of normative effects were found.

Mediated by the continual intention, the beliefs accounted for from 11 up to 18 percent of the variance of trading furniture, having social interaction, and playing in-world games. This finding highlights the multi-purpose nature of SVWs and indicates the prominence of these three types of purposes amongst users. Moreover, despite the fact that behavior in SVWs may be subject to other important determinants such as emotions (e.g., Bubnitz,

Claybaugh, & Perracchio, 2009), the impact of continual use intention on the behaviors was rather strong (trading furniture: $\beta = 0.33$; having social interaction: $\beta = 0.39$; playing in-world games: $\beta = 0.42$). This suggests that while behavior in social game-like online environments may well be emotionally driven, it is still performed to a large extent intentionally.

Implications for theory and practice

The findings of this study have several theoretical implications. First, insight into how attitudinal, normative, and control beliefs jointly influence behavior in SVWs has been a somewhat open question. This study has examined this issue empirically and demonstrated that attitudinal and control beliefs are one of the pivotal structures underlying the formation of SVW continual use intentions. The study further revealed direct paths from continual use intentions to the three most salient actual behaviors within the context of SVWs, confirming the nature of SVWs as multi-purpose systems (cf. Hong et al., 2006). Together these findings show us that attitudinal and control beliefs have second-order influences on within-SVW behavior. Second, by identifying the individual key beliefs behind continual use intentions our study has enhanced theoretical knowledge of developing behavioral frameworks built upon DTPB (S. Taylor & Todd, 1995a; S. Taylor & Todd, 1995b). Not only do the proposed decomposed beliefs demonstrate the value of the theory when delineating the key beliefs underlying specific behavior, but they also embody a test of a DTPB structure in SVW settings. Such contextual extension should be seen as test of theoretical effectiveness as it adds to the generalizability of the DTPB (Berthon, Pitt, Ewing, & Carr, 2002). Third, the fact that we found direct influences of the different beliefs on continual use intentions puts the original structure of the DTPB into perspective. While its decomposed approach enables researchers to present a set of beliefs specific to the situation, the inclusion of the attitude, subjective norms and perceived behavioral control as mediating factors between the decomposed beliefs and the continual use intention gives rise to debate. Such mediating

structure contrasts with scholars advocating more direct approaches when considering multiple act criteria and more complex behavior (e.g., Stutzman & Green, 1982). Furthermore, postulation of this mediating structure holds little value when the mediating factor is not expected to fully mediate the relationships between the beliefs and the other variable(s) in the pre-specified conceptual model (Chin, 1998). Given the ample empirical evidence on direct effects of system-specific attitudinal, normative, and control beliefs on online behavioral intentions (e.g., J. Lee & Rao, 2007; Parra-López, Bulchand-Gidumal, Gutiérrez-Taño, & Díaz-Armas, 2010; Verhagen & van Dolen, 2009; Vijayasarathy, 2004) the original structure of the DTPB may demand reconsideration.

The study contributes to SVW development in several ways. It demonstrates that operators of SVWs can benefit from developing and implementing the right mix of enjoying and useful features when building SVW environments, adding to basic attitudinal beliefs of their users. Although offering enjoyable features should be high on the priority list, this study also shows that SVWs are perceived as useful tools, for example when spending leisure time, communicating with peers or expressing oneself. This finding warns operators against neglecting the value of instrumental features as this would mean losing the option to positively influence the use of SVWs. Furthermore, our findings underline the value of paying attention to characteristics that determine the control and representation of avatars. SVW users navigate, communicate and express themselves in the SVW environment through avatars. Our findings encourage the further development of avatar features that increase the usability of SVWs, as well as those that elevate the level of self-efficacy of their users. Finally, this study reveals that the influence of the referent group of SVW users is less than expected. Based on this finding anyone willing to influence behavior of SVW users, such as operators of SVWs and parents of SVW users, must be aware of the fact that referents play only a minor role in this context. This implies, for example, that operators should not

primarily rely on referents when introducing new features, training users or wanting to stimulate behavior that fits the objectives of the SVW.

Limitations and future research

This study has been subject to a number of limitations. First, the model has been validated by making use of a sample of respondents living in Western culture. Previous research has shown that culture is likely to affect the extent to which information system perceptions influence user behavior (e.g., Al-Gahtani, Hubona, & Wang, 2007). This might even put the rather insignificant influence of normative beliefs into perspective as teenagers in more collectivistic cultures might more substantially rely on the opinions of friends, family and relatives (Palan et al., 2010). More research is needed to address this issue. Second, the data collection was restricted to one SVW. While the SVW in the study is one of the most popular SVWs worldwide, and the purposes it is used for mirror the key purposes of SVW usage in general (eMarketer, 2009), our research findings may not be fully generalizable. We encourage researchers to cross-validate our findings with other SVWs. Third, the gender bias towards young women in our sample may have influenced our findings. For example, the influence of skills on exploratory behavior is assumed to be stronger for women than for men (Richard, Chebat, Yang, & Putrevu, 2010). This might have had an upward biasing effect on the role of control beliefs. Comparably, as women tend to be less task-focused than men and use websites more for enjoyment (Richard et al., 2010), this might have tilted the balance between the attitudinal beliefs enjoyment and usefulness towards the former. A line of future inquiry could address these issues. Fourth, the decomposed beliefs in the model were selected due to their applicability to SVW settings but are by no means meant to be complete. While the predictive validity of our model was more than acceptable, at the same time it offers opportunities for future extensions and refinements.

Acknowledgements

The authors would like to state their gratitude to the Finnish Youth Research Society, Foundation for Economic Education, and Sulake Corporation for assistance in conducting this study. The authors also thank the European Commission who partly funded the project through the Metaverse1 project (ITEA2) and Novay, the Dutch consortium on IT and open innovation.

References

- Agarwal, R., & Karahanna, E. (2000). Time flies when you're having fun: Cognitive absorption and beliefs about information technology usage. *MIS Quarterly*, 24(4), 665-694.
- Agarwal, R., Sambamurthy, V., & Ralph, M. S. (2000). Research report: The evolving relationship between general and specific computer self-efficacy - an empirical assessment. *Information Systems Research*, 11(4), 418-430.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211.
- Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *Journal of Applied Social Psychology*, 32(4), 665-683.
- Ajzen, I. (2005). *Attitudes, personality, and behavior* (2nd ed.). Maidenhead: Open University Press.
- Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs: NJ: Prentice-Hall.

- Ajzen, I., & Madden, T. J. (1986). Prediction of goal-directed behavior: Attitudes, intentions, and perceived behavioral control. *Journal of Experimental Social Psychology*, 22(5), 453-474.
- Al-Gahtani, S. S., Hubona, G. S., & Wang, J. (2007). Information technology (IT) in Saudi Arabia: Culture and the acceptance and use of IT. *Information & Management*, 44(8), 681-691.
- Bagozzi, R. P. (1981). Attitudes, intentions, and behavior: A test of some key hypotheses. *Journal of Personality and Social Psychology*, 41(4), 607-627.
- Bainbridge, W. S. (2007). The scientific research potential of virtual worlds. *Science*, 317(5837), 472-476.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioural change. *Psychological Review*, 84(2), 191-215.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.
- Bartle, R. A. (2003). *Designing virtual worlds*. Indianapolis: New Riders.
- Bentler, M. P., & Speckart, G. (1979). Models of attitude-behavior relations. *Psychological Review*, 86(5), 452-464.
- Berthon, P., Pitt, L., Ewing, M., & Carr, C.,L. (2002). Potential research space in MIS: A framework for envisioning and evaluating research replication, extension, and generation. *Information Systems Research*, 13(4), 416-427.

Book, B. (2004). Moving beyond the game: Social virtual worlds. *State of Play 2 Conference*, New York, NY.

Bublitz, M. G., Claybaugh, C. C., & Perracchio, L. A. (2009). Mirror, mirror on the web: Understanding thin-slice judgments of avatars. In N. T. Wood, & M. R. Solomin (Eds.), *Virtual social identity and Consumer behavior* (pp. 192-206). Armonk, NY.: M.E. Sharpe.

Caoili, E. (2010). *Sulake sees best quarter ever with revenue up 25 percent to \$20 million*. Retrieved 07/10, 2010, from http://www.gamasutra.com/view/news/28656/Sulake_Sees_Best_Quarter_Ever_With_Revenue_Up_25_Percent_To_20_Million.php

Childers, T. L., & Rao, A., R. (1992). The influence of familiar and peer-based reference groups on consumer decisions. *Journal of Consumer Research*, 19(2), 198-221.

Chin, W. W. (1998). Issues and opinions on structural equation modeling. *MIS Quarterly*, 22(1), 7-15.

Christopher, R. P., John, S. H., & Vandenbosch, M. (2001). Research report: Richness versus parsimony in modeling technology adoption decisions - understanding merchant adoption of a smart card-based payment system. *Information Systems Research*, 12(2), 208-222.

Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: Development of a measure and initial test. *MIS Quarterly*, 19(2), 189-211.

- Craig, V. S., Ilie, V., Lou, H., & Stafford, T. (2007). Perceived critical mass and the adoption of a communication technology. *European Journal of Information Systems*, 16(3), 270-283.
- Csikszentmihályi, M. (1975). In Csikszentmihalyi I. (Ed.), *Beyond boredom and anxiety: The experience of play in work and games*. San Francisco, CA: Jossey-Bass Publishers.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-340.
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35(8), 982-1003.
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Social Psychology*, 22(14), 1111-1132.
- Deci, E., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227-268.
- Dholakia, U. M., Bagozzi, R. P., & Pearo, L. K. (2004). A social influence model of consumer participation in network- and small-group-based virtual communities. *International Journal of Research in Marketing*, 21(3), 241-263.
- eMarketer. (2009). *Real kids in virtual worlds*. Retrieved September 29th 2010, 2010, from <http://www.emarketer.com/>

- Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*. Reading, MA.: Addison-Wesley.
- Fisher, W. A. (1984). Predicting contraceptive behavior among university men: The role of emotions and behavioral intentions. *Journal of Applied Social Psychology*, 14(2), 104-123.
- Fornell, C., & Bookstein, F. L. (1982). Two structural equation models: LISREL and PLS applied to consumer exit-voice theory. *Journal of Marketing Research*, 19(4), 440-452.
- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39-50.
- Graham, L. B., & Beverley, A. S. (2002). Service locus of control: Its conceptualization and measurement. *Journal of Service Research*, 4(4), 312-324.
- Habbo Hotel. (2006). *Global Habbo youth survey*. Helsinki: 15/30 Research.
- Habbo Hotel. (2008). *Global Habbo youth survey*. Helsinki: 15/30 Research.
- Holbrook, M. B., Chestnut, R. W., Terence, A. O., & Greenleaf, E. A. (1984). Play as a consumption experience: The roles of emotions, performance, and personality in the enjoyment of games. *Journal of Consumer Research*, 11(2), 728-739.
- Hong, S., Thong, J. Y. L., & Tam, K. Y. (2006). Understanding continued information technology usage behavior: A comparison of three models in the context of mobile internet. *Decision Support Systems*, 42(3), 1819-1834.

- Hsieh, J. J. P., Rai, A., & Keil, M. (2008). Understanding digital inequality: Comparing continued use behavioral models of the socio-economically advantaged and disadvantaged. *MIS Quarterly*, 32(1), 97-126.
- Huizinga, J. (1955). *Homo Ludens: A study of the play-element in culture*. Boston, MA: Beacon.
- Jung, Y., & Kang, H. (2010). User goals in social virtual worlds: A means-end chain approach. *Computers in Human Behavior*, 26(2), 218-225.
- Kantola, S. J., Syme, G. J., & Campbell, N. A. (1982). The role of individual differences and external variables in a test of the sufficiency of Fishbein's model to explain behavioral intentions to conserve water. *Journal of Applied Social Psychology*, 12(1), 70-83.
- Karahanna, E., Straub, D. W., & Chervany, N. L. (1999). Information technology adoption across time: A cross-sectional comparison of pre-adoption and post-adoption beliefs. *MIS Quarterly*, 23(2), 183-213.
- Katz, R. (1980). Time and work: Towards an integrative perspective. In B. M. Staw, & L. L. Cummings (Eds.), (pp. 81-127). Greenwich, CT: JAI Press.
- Kim, J., Song, J., & Jones, D.,R. (2010). The cognitive selection framework for knowledge acquisition strategies in virtual communities. *International Journal of Information Management*, Forthcoming(xx), xx-xx.
- kZero. (2009). *Kids, tweens and teens in virtual worlds*. kZero worldwide, available from <http://www.kzero.co.uk/research-reports.php>.

- Lee, J., & Rao, H. R. (2007). Perceived risks, counter-beliefs, and intentions to use anti-/counter-terrorism websites: An exploratory study of government-citizens online interactions in a turbulent environment. *Decision Support Systems*, 43(4), 1431-1449.
- Lee, K., Tsai, M., & Lanting, M. C. L. (2010). From marketplace to marketspace: Investigating the consumer switch to online banking. *Electronic Commerce Research and Applications*, Forthcoming(xx), xx-xx.
- Lehdonvirta, V. (2009). Virtual items sales as a revenue model: Identifying attributes that drive purchase decisions. *Electronic Commerce Research*, 9(1-2), 97-113.
- Li, D., Chua, P. Y. K., & Lu, H., Lou. (2005). Understanding individual adoption of instant messaging: An empirical investigation. *Journal of the Association for Information Systems*, 6(4), 102-129.
- Lou, H., Luo, W., & Strong, D. (2000). Perceived critical mass effect on groupware acceptance. *European Journal of Information Systems*, 9(2), 91-103.
- Malone, T. W. (1981). Toward a theory of intrinsically motivating instruction. *Cognitive Science*, 5(4), 333-369.
- Markus, M. L. (1990). Toward a 'Critical mass' theory of interactive media: Universal access, interdependence and diffusion. In J. Fulk, & C. Steinfield (Eds.), *Organizations and communication technology* (pp. 194-218). Newbury Park, CA: Sage.
- Markus, M. L. (1994). Electronic mail as the medium of managerial choice. *Organization Science*, 5(4), 502-527.

- Matei, S., & Ball-Rokeach, S. (2001). Real and virtual social ties: Connections in the everyday lives of seven ethnic neighborhoods. *American Behavioral Scientist*, 45(3), 550-564.
- Meng-Hsiang Hsu, & Chao-Min Chiu. (2004). Internet self-efficacy and electronic service acceptance. *Decision Support Systems*, 38(3), 369-381.
- Moon, J., & Kim, Y. (2001). Extending the TAM for a world-wide-web context. *Information & Management*, 38(4), 217-230.
- Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.
- Palan, K. M., Gentina, E., & Muratore, I. (2010). Adolescent consumption autonomy: A cross-cultural examination. *Journal of Business Research*, *Forthcoming*(xx), xx-xx.
- Parra-López, E., Bulchand-Gidumal, J., Gutiérrez-Taño, D., & Díaz-Armas, R. (2010). Intentions to use social media in organizing and taking vacation trips. *Computers in Human Behavior*, *Forthcoming*(xx), xx-xx.
- Paterson, J. E., field, J., & Pryor, J. (1994). Adolescents' perceptions of their attachment relationships with their mothers, fathers, and friends. *Addictive Behaviors*, 23(5), 579-600.
- Pavlou, P. A., Huigang, L., & Yajiong, X. (2007). Understanding and mitigating uncertainty in online exchange relationships: A principal--agent perspective. *MIS Quarterly*, 31(1), 105-136.
- Ping, R. A. J. (2004). On assuring valid measures for theoretical models using survey data. *Journal of Business Research*, 57(2), 125-141.

- Premkumar, G., Ramamurthy, K., & Liu, H. (2008). Internet messaging: An examination of the impact of attitudinal, normative, and control belief systems. *Information & Management, 45*(7), 451-457.
- Richard, M., Chebat, J., Yang, Z., & Putrevu, S. (2010). A proposed model of online consumer behavior: Assessing the role of gender. *Journal of Business Research, 63*(9), 926-934.
- Ringle, C. M., Wende, S. & Will, S. (2005). *SmartPLS 2.0 (M3) beta*. Retrieved September 8th 2010, 2010, from <http://www.smartpls.de>
- Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York, NY: Free Press.
- Ruvio, A. (2008). Consumers' need for uniqueness: Short-form scale development and cross-cultural validation. *International Marketing Review, 25*(1), 33-53.
- Ryan, R. M., Rigby, S. C., & Brzybylski, A. (2006). The motivational pull of video games: A self-determination theory approach. *Motivation and Emotion, 30*(4), 344-360.
- Snyder, C. R., & Fromkin, H. L. (1977). Abnormality as a positive characteristic: The development and validation of a scale measuring need for uniqueness. *Journal of Abnormal Psychology, 86*(5), 518-527.
- Strader, T. J., Ramaswami, S. N., & Houle, P. A. (2007). Perceived network externalities and communication technology acceptance. *European Journal of Information Systems, 16*(1), 54-65.
- Stutzman, T. M., & Green, S. B. (1982). Factors affecting energy consumption: Two field tests of the Fishbein-Ajzen model. *The Journal of Social Psychology, 117*(2), 183-201.

- Taylor, S., & Todd, P. (1995a). Decomposition and crossover effects in the theory of planned behavior: A study of consumer adoption intentions. *International Journal of Research in Marketing*, 12(2), 137-155.
- Taylor, S., & Todd, P. A. (1995b). Understanding information technology usage: A test of competing models. *Information Systems Research*, 6(2), 144-176.
- Taylor, T. L. (2006). *Play between worlds: Exploring online game culture*. Cambridge, MA: MIT Press.
- Teo, T. S. H., Lim, V. K. G., & Lai, R. Y. C. (1999). Intrinsic and extrinsic motivation in internet usage. *Omega*, 27(1), 25-37.
- Tian, K. T. (2001). Consumers' need for uniqueness: Scale development and validation. *Journal of Consumer Research*, 28(1), 50-66.
- Toh, R. S., & Hu, M. Y. (1996). Natural mortality and participation fatigue as potential biases in diary panels: Impact of some demographic factors and behavioral characteristics on systematic attrition. *Journal of Business Research*, 35(2), 129-138.
- Triandis, H. C. (1979). Values, attitudes, and interpersonal behavior. In M. M. Page (Ed.), *Nebraska symposium on motivation, belief, and attitude, and values* (Lincoln, NE ed., pp. 195-259) University of Nebraska Press.
- Valente, T. W. (1995). *Network models of the diffusion of innovations*. Cresskill, NJ: Hampton Press.
- van der Heijden, H. (2003). Factors influencing the usage of websites: The case of a generic portal in the Netherlands. *Information & Management*, (6), 541-549.

- van der Heijden, H. (2004). User acceptance of hedonic information systems. *MIS Quarterly*, 28(4), 695-704.
- Vasalou, A., Joinson, A., Bänziger, T., Goldie, P., & Pitt, J. (2008). Avatars in social media: Balancing accuracy, playfulness and embodied messages. *International Journal of Human-Computer Studies*, 66(11), 801-811.
- Venkatesh, V., & Brown, S. A. (2001). A longitudinal investigation of personal computers in homes: Adoption determinants and emerging challenges. *MIS Quarterly*, 25(1), 71-102.
- Verhagen, T., & van Dolen, W. (2009). Online purchase intentions: A multi-channel store image perspective. *Information & Management*, 46(2), 77-82.
- Vijayasarathy, L. R. (2004). Predicting consumer intentions to use on-line shopping: The case for an augmented technology acceptance model. *Information & Management*, 41(6), 747-762.
- Webster, J., & Trevino, L. K. (1995). Rational and social theories as complementary explanations of communication media choices: Two policy-capturing studies. *Academy of Management Journal*, 38(6), 1544-1572.
- Youniss, J., & Smollar, J. (1985). The individual and relations. In J. Youniss, & J. Smollar (Eds.), *Adolescent relations with mothers, fathers, and friends* (pp. 160-176). Chicago, IL: The University of Chicago Press.
- Zhou, Z., Jin, X., Vogel, D. R., Fang, Y., & Chen, X. (2010). Individual motivations and demographic differences in social virtual world uses: An exploratory investigation in second life. *International Journal of Information Management*, Forthcoming(xx), xx-xx.

Appendix 1 Scales and measure items

Constructs	Items (1=Strongly disagree; 7=Strongly agree)	Source
Enjoyment	It is enjoyable to use Habbo It is fun to use Habbo It is entertaining to use Habbo	(Hsieh et al., 2008; Venkatesh & Brown, 2001)
Perceived Usefulness	Is a good thing Comes in handy for my communication Is a good way to spend free time Allows me to express myself	(Davis et al., 1989; Davis, 1989)
Referents	My family thinks I should use Habbo My relatives think I should use Habbo My friends think I should use Habbo	(Ajzen, 2005; Karahanna et al., 1999)
Perceived Critical Mass	How many people about your age use Habbo? How many of your friends use Habbo? How many people most meaningful to you use Habbo?	(Lou et al., 2000; Valente, 1995)
Perceived Ease of Use	I find Habbo easy to use I find it easy to do what I intend to do in Habbo Using Habbo does not require a lot of my mental effort Using Habbo to communicate with others is clear and understandable	(Davis et al., 1989; Davis, 1989; Hsieh et al., 2008)
Self-	I feel comfortable using Habbo on my own	(Agarwal et al., 2000;

Efficacy	I can easily operate in Habbo on my own	Bandura, 1977; Compeau
	I feel comfortable using Habbo even if there	& Higgins, 1995)
	is no one around me to tell how to use it	
Continual	I intend to continue using Habbo during the	(Ajzen & Madden, 1986;
Intention	next three months	Ajzen, 1991)
	I intend to revisit Habbo shortly	
	I predict I will revisit Habbo in the short term	

Actual behaviors: *At The Moment, What Do You Like To Do In Habbo?* (1=Strongly disagree; 7=Strongly agree)

Trading in	I like purchasing "furni"	(Habbo Hotel, 2006;
furniture	I like collecting valuable "furni"	Habbo Hotel, 2008)
	I like collecting fashionable "furni"	
Interacting	I like communicating with other Habbo users	
with	I like making friends with other Habbo users	
others	I like chatting and hanging out with friends	
Playing	I like events arranged by Habbo staff	
games	I like events arranged by other Habbo users	
	I like playing games	

2006-1	Tibert Verhagen Selmar Meents Yao-Hua Tan	Perceived risk and trust associated with purchasing at Electronic Marketplaces, 39 p.
2006-2	Mediha Sahin Marius Rietdijk Peter Nijkamp	Ethnic employees' behaviour vis-à-vis customers in the service sector, 17 p.
2006-3	Albert J. Menkveld	Splitting orders in overlapping markets: A study of cross-listed stocks, 45 p.
2006-4	Kalok Chan Albert J. Menkveld Zhishu Yang	Are domestic investors better informed than foreign investors? Evidence from the perfectly segmented market in China, 33 p.
2006-5	Kalok Chan Albert J. Menkveld Zhishu Yang	Information asymmetry and asset prices: Evidence from the China foreign share discount, 38 p.
2006-6	Albert J. Menkveld Yiu C. Cheung Frank de Jong	Euro-area sovereign yield dynamics: The role of order imbalance, 34 p.
2006-7	Frank A.G. den Butter	The industrial organisation of economic policy preparation in the Netherlands
2006-8	Evgenia Motchenkova	Cost minimizing sequential punishment policies for repeat offenders, 20 p.
2006-9	Ginés Hernández- Cánovas Johanna Koëter- Kant	SME Financing in Europe: Cross-country determinants of debt maturity, 30 p.
2006-10	Pieter W. Jansen	Did capital market convergence lower the effectiveness of the interest rate as a monetary policy tool? 17 p.
2006-11	Pieter W. Jansen	Low inflation, a high net savings surplus and institutional restrictions keep the long-term interest rate low. 24 p.
2006-12	Joost Baeten Frank A.G. den Butter	Welfare gains by reducing transactions costs: Linking trade and innovation policy, 28 p.
2006-13	Frank A.G. den Butter Paul Wit	Trade and product innovations as sources for productivity increases: an empirical analysis, 21 p.
2006-14	M. Francesca Cracolici Miranda Cuffaro Peter Nijkamp	Sustainable tourist development in Italian Holiday destination, 10 p.

2006-15	Simonetta Longhi Peter Nijkamp	Forecasting regional labor market developments under spatial heterogeneity and spatial correlation, 25 p
2006-16	Mediha Sahin Peter Nijkamp Tüzin Baycan-Levent	Migrant Entrepreneurship from the perspective of cultural diversity, 21 p.
2006-17	W.J. Wouter Botzen Philip S. Marey	Does the ECB respond to the stock market? 23 p.
2006-18	Tüzin Baycan-Levent Peter Nijkamp	Migrant female entrepreneurship: Driving forces, motivation and performance, 31 p.
2006-19	Ginés Hernández-Cánovas Johanna Koëter-Kant	The European institutional environment and SME relationship lending: Should we care? 24 p.
2006-20	Miranda Cuffaro Maria Francesca Cracolici Peter Nijkamp	Economic convergence versus socio-economic convergence in space, 13 p.
2006-21	Mediha Sahin Peter Nijkamp Tüzin Baycan-Levent	Multicultural diversity and migrant entrepreneurship: The case of the Netherlands, 29 p.

2007-1	M. Francesca Cracolici Miranda Cuffaro Peter Nijkamp	Geographical distribution of enemployment: An analysis of provincial differences in Italy, 21 p.
2007-2	Daniel Leliefeld Evgenia Motchenkova	To protect in order to serve, adverse effects of leniency programs in view of industry asymmetry, 29 p.
2007-3	M.C. Wassenaar E. Dijkgraaf R.H.J.M. Gradus	Contracting out: Dutch municipalities reject the solution for the VAT-distortion, 24 p.
2007-4	R.S. Halbersma M.C. Mikkers E. Motchenkova I. Seinen	Market structure and hospital-insurer bargaining in the Netherlands, 20 p.
2007-5	Bas P. Singer Bart A.G. Bossink Herman J.M. Vande Putte	Corporate Real estate and competitive strategy, 27 p.
2007-6	Dorien Kooij Annet de Lange Paul Jansen Josje Dijkers	Older workers' motivation to continue to work: Five meanings of age. A conceptual review, 46 p.
2007-7	Stella Flytzani Peter Nijkamp	Locus of control and cross-cultural adjustment of expatriate managers, 16 p.
2007-8	Tibert Verhagen Willemijn van Dolen	Explaining online purchase intentions: A multi-channel store image perspective, 28 p.
2007-9	Patrizia Riganti Peter Nijkamp	Congestion in popular tourist areas: A multi-attribute experimental choice analysis of willingness-to-wait in Amsterdam, 21 p.
2007-10	Tüzin Baycan-Levent Peter Nijkamp	Critical success factors in planning and management of urban green spaces in Europe, 14 p.
2007-11	Tüzin Baycan-Levent Peter Nijkamp	Migrant entrepreneurship in a diverse Europe: In search of sustainable development, 18 p.
2007-12	Tüzin Baycan-Levent Peter Nijkamp Mediha Sahin	New orientations in ethnic entrepreneurship: Motivation, goals and strategies in new generation ethnic entrepreneurs, 22 p.
2007-13	Miranda Cuffaro Maria Francesca Cracolici Peter Nijkamp	Measuring the performance of Italian regions on social and economic dimensions, 20 p.

2007-14	Tüzin Baycan-Levent Peter Nijkamp	Characteristics of migrant entrepreneurship in Europe, 14 p.
2007-15	Maria Teresa Borzacchiello Peter Nijkamp Eric Koomen	Accessibility and urban development: A grid-based comparative statistical analysis of Dutch cities, 22 p.
2007-16	Tibert Verhagen Selmar Meents	A framework for developing semantic differentials in IS research: Assessing the meaning of electronic marketplace quality (EMQ), 64 p.
2007-17	Aliye Ahu Gülümser Tüzin Baycan Levent Peter Nijkamp	Changing trends in rural self-employment in Europe, 34 p.
2007-18	Laura de Dominicis Raymond J.G.M. Florax Henri L.F. de Groot	De ruimtelijke verdeling van economische activiteit: Agglomeratie- en locatiepatronen in Nederland, 35 p.
2007-19	E. Dijkgraaf R.H.J.M. Gradus	How to get increasing competition in the Dutch refuse collection market? 15 p.

2008-1	Maria T. Borzacchiello Irene Casas Biagio Ciuffo Peter Nijkamp	Geo-ICT in Transportation Science, 25 p.
2008-2	Maura Soekijad Jeroen Walschots Marleen Huysman	Congestion at the floating road? Negotiation in networked innovation, 38 p.
2008-3	Marlous Agterberg Bart van den Hooff Marleen Huysman Maura Soekijad	Keeping the wheels turning: Multi-level dynamics in organizing networks of practice, 47 p.
2008-4	Marlous Agterberg Marleen Huysman Bart van den Hooff	Leadership in online knowledge networks: Challenges and coping strategies in a network of practice, 36 p.
2008-5	Bernd Heidergott Haralambie Leahu	Differentiability of product measures, 35 p.
2008-6	Tibert Verhagen Frans Feldberg Bart van den Hooff Selmar Meents	Explaining user adoption of virtual worlds: towards a multipurpose motivational model, 37 p.
2008-7	Masagus M. Ridhwan Peter Nijkamp Piet Rietveld Henri L.F. de Groot	Regional development and monetary policy. A review of the role of monetary unions, capital mobility and locational effects, 27 p.
2008-8	Selmar Meents Tibert Verhagen	Investigating the impact of C2C electronic marketplace quality on trust, 69 p.
2008-9	Junbo Yu Peter Nijkamp	China's prospects as an innovative country: An industrial economics perspective, 27 p
2008-10	Junbo Yu Peter Nijkamp	Ownership, r&d and productivity change: Assessing the catch-up in China's high-tech industries, 31 p
2008-11	Elbert Dijkgraaf Raymond Gradus	Environmental activism and dynamics of unit-based pricing systems, 18 p.
2008-12	Mark J. Koetse Jan Rouwendal	Transport and welfare consequences of infrastructure investment: A case study for the Betuweroute, 24 p
2008-13	Marc D. Bahlmann Marleen H. Huysman Tom Elfring Peter Groenewegen	Clusters as vehicles for entrepreneurial innovation and new idea generation – a critical assessment
2008-14	Soushi Suzuki Peter Nijkamp	A generalized goals-achievement model in data envelopment analysis: An application to efficiency improvement in local government finance in Japan, 24 p.
2008-15	Tüzin Baycan-Levent	External orientation of second generation migrant entrepreneurs. A sectoral

	Peter Nijkamp Mediha Sahin	study on Amsterdam, 33 p.
2008-16	Enno Masurel	Local shopkeepers' associations and ethnic minority entrepreneurs, 21 p.
2008-17	Frank Frößler Boriana Rukanova Stefan Klein Allen Higgins Yao-Hua Tan	Inter-organisational network formation and sense-making: Initiation and management of a living lab, 25 p.
2008-18	Peter Nijkamp Frank Zwetsloot Sander van der Wal	A meta-multicriteria analysis of innovation and growth potentials of European regions, 20 p.
2008-19	Junbo Yu Roger R. Stough Peter Nijkamp	Governing technological entrepreneurship in China and the West, 21 p.
2008-20	Maria T. Borzacchiello Peter Nijkamp Henk J. Scholten	A logistic regression model for explaining urban development on the basis of accessibility: a case study of Naples, 13 p.
2008-21	Marius Ooms	Trends in applied econometrics software development 1985-2008, an analysis of Journal of Applied Econometrics research articles, software reviews, data and code, 30 p.
2008-22	Aliye Ahu Gülümser Tüzin Baycan-Levent Peter Nijkamp	Changing trends in rural self-employment in Europe and Turkey, 20 p.
2008-23	Patricia van Hemert Peter Nijkamp	Thematic research prioritization in the EU and the Netherlands: an assessment on the basis of content analysis, 30 p.
2008-24	Jasper Dekkers Eric Koomen	Valuation of open space. Hedonic house price analysis in the Dutch Randstad region, 19 p.

2009-1	Boriana Rukanova Rolf T. Wignand Yao-Hua Tan	From national to supranational government inter-organizational systems: An extended typology, 33 p.
2009-2	Marc D. Bahlmann Marleen H. Huysman Tom Elfring Peter Groenewegen	Global Pipelines or global buzz? A micro-level approach towards the knowledge-based view of clusters, 33 p.
2009-3	Julie E. Ferguson Marleen H. Huysman	Between ambition and approach: Towards sustainable knowledge management in development organizations, 33 p.
2009-4	Mark G. Leijssen	Why empirical cost functions get scale economies wrong, 11 p.
2009-5	Peter Nijkamp Galit Cohen-Blankshtain	The importance of ICT for cities: e-governance and cyber perceptions, 14 p.
2009-6	Eric de Noronha Vaz Mário Caetano Peter Nijkamp	Trapped between antiquity and urbanism. A multi-criteria assessment model of the greater Cairo metropolitan area, 22 p.
2009-7	Eric de Noronha Vaz Teresa de Noronha Vaz Peter Nijkamp	Spatial analysis for policy evaluation of the rural world: Portuguese agriculture in the last decade, 16 p.
2009-8	Teresa de Noronha Vaz Peter Nijkamp	Multitasking in the rural world: Technological change and sustainability, 20 p.
2009-9	Maria Teresa Borzacchiello Vincenzo Torrieri Peter Nijkamp	An operational information systems architecture for assessing sustainable transportation planning: Principles and design, 17 p.
2009-10	Vincenzo Del Giudice Pierfrancesco De Paola Francesca Torrieri Francesca Pagliari Peter Nijkamp	A decision support system for real estate investment choice, 16 p.
2009-11	Miruna Mazurencu Marinescu Peter Nijkamp	IT companies in rough seas: Predictive factors for bankruptcy risk in Romania, 13 p.
2009-12	Boriana Rukanova Helle Zinner Hendriksen Eveline van Stijn Yao-Hua Tan	Bringing is innovation in a highly-regulated environment: A collective action perspective, 33 p.
2009-13	Patricia van Hemert Peter Nijkamp Jolanda Verbraak	Evaluating social science and humanities knowledge production: an exploratory analysis of dynamics in science systems, 20 p.

2009-14	Roberto Patuelli Aura Reggiani Peter Nijkamp Norbert Schanne	Neural networks for cross-sectional employment forecasts: A comparison of model specifications for Germany, 15 p.
2009-15	André de Waal Karima Kourtit Peter Nijkamp	The relationship between the level of completeness of a strategic performance management system and perceived advantages and disadvantages, 19 p.
2009-16	Vincenzo Punzo Vincenzo Torrieri Maria Teresa Borzacchiello Biagio Ciuffo Peter Nijkamp	Modelling intermodal re-balance and integration: planning a sub-lagoon tube for Venezia, 24 p.
2009-17	Peter Nijkamp Roger Stough Mediha Sahin	Impact of social and human capital on business performance of migrant entrepreneurs – a comparative Dutch-US study, 31 p.
2009-18	Dres Creal	A survey of sequential Monte Carlo methods for economics and finance, 54 p.
2009-19	Karima Kourtit André de Waal	Strategic performance management in practice: Advantages, disadvantages and reasons for use, 15 p.
2009-20	Karima Kourtit André de Waal Peter Nijkamp	Strategic performance management and creative industry, 17 p.
2009-21	Eric de Noronha Vaz Peter Nijkamp	Historico-cultural sustainability and urban dynamics – a geo-information science approach to the Algarve area, 25 p.
2009-22	Roberta Capello Peter Nijkamp	Regional growth and development theories revisited, 19 p.
2009-23	M. Francesca Cracolici Miranda Cuffaro Peter Nijkamp	Tourism sustainability and economic efficiency – a statistical analysis of Italian provinces, 14 p.
2009-24	Caroline A. Rodenburg Peter Nijkamp Henri L.F. de Groot Erik T. Verhoef	Valuation of multifunctional land use by commercial investors: A case study on the Amsterdam Zuidas mega-project, 21 p.
2009-25	Katrin Oltmer Peter Nijkamp Raymond Florax Floor Brouwer	Sustainability and agri-environmental policy in the European Union: A meta-analytic investigation, 26 p.
2009-26	Francesca Torrieri Peter Nijkamp	Scenario analysis in spatial impact assessment: A methodological approach, 20 p.
2009-27	Aliye Ahu Gülümser Tüzin Baycan-Levent Peter Nijkamp	Beauty is in the eyes of the beholder: A logistic regression analysis of sustainability and locality as competitive vehicles for human settlements, 14 p.

2009-28	Marco Percoco Peter Nijkamp	Individual time preferences and social discounting in environmental projects, 24 p.
2009-29	Peter Nijkamp Maria Abreu	Regional development theory, 12 p.
2009-30	Tüzin Baycan-Levent Peter Nijkamp	7 FAQs in urban planning, 22 p.
2009-31	Aliye Ahu Gülümser Tüzin Baycan-Levent Peter Nijkamp	Turkey's rurality: A comparative analysis at the EU level, 22 p.
2009-32	Frank Bruinsma Karima Kourtit Peter Nijkamp	An agent-based decision support model for the development of e-services in the tourist sector, 21 p.
2009-33	Mediha Sahin Peter Nijkamp Marius Rietdijk	Cultural diversity and urban innovativeness: Personal and business characteristics of urban migrant entrepreneurs, 27 p.
2009-34	Peter Nijkamp Mediha Sahin	Performance indicators of urban migrant entrepreneurship in the Netherlands, 28 p.
2009-35	Manfred M. Fischer Peter Nijkamp	Entrepreneurship and regional development, 23 p.
2009-36	Faroek Lazrak Peter Nijkamp Piet Rietveld Jan Rouwendal	Cultural heritage and creative cities: An economic evaluation perspective, 20 p.
2009-37	Enno Masurel Peter Nijkamp	Bridging the gap between institutions of higher education and small and medium-size enterprises, 32 p.
2009-38	Francesca Medda Peter Nijkamp Piet Rietveld	Dynamic effects of external and private transport costs on urban shape: A morphogenetic perspective, 17 p.
2009-39	Roberta Capello Peter Nijkamp	Urban economics at a cross-yard: Recent theoretical and methodological directions and future challenges, 16 p.
2009-40	Enno Masurel Peter Nijkamp	The low participation of urban migrant entrepreneurs: Reasons and perceptions of weak institutional embeddedness, 23 p.
2009-41	Patricia van Hemert Peter Nijkamp	Knowledge investments, business R&D and innovativeness of countries. A qualitative meta-analytic comparison, 25 p.
2009-42	Teresa de Noronha Vaz Peter Nijkamp	Knowledge and innovation: The strings between global and local dimensions of sustainable growth, 16 p.
2009-43	Chiara M. Traversi Peter Nijkamp	Managing environmental risk in agriculture: A systematic perspective on the potential of quantitative policy-oriented risk valuation, 19 p.
2009-44	Sander de Leeuw	Logistics aspects of emergency preparedness in flood disaster prevention, 24 p.

Iris F.A. Vis
Sebastiaan B. Jonkman

2009-45	Eveline S. van Leeuwen Peter Nijkamp	Social accounting matrices. The development and application of SAMs at the local level, 26 p.
2009-46	Tibert Verhagen Willemijn van Dolen	The influence of online store characteristics on consumer impulsive decision-making: A model and empirical application, 33 p.
2009-47	Eveline van Leeuwen Peter Nijkamp	A micro-simulation model for e-services in cultural heritage tourism, 23 p.
2009-48	Andrea Caragliu Chiara Del Bo Peter Nijkamp	Smart cities in Europe, 15 p.
2009-49	Farook Lazrak Peter Nijkamp Piet Rietveld Jan Rouwendal	Cultural heritage: Hedonic prices for non-market values, 11 p.
2009-50	Eric de Noronha Vaz João Pedro Bernardes Peter Nijkamp	Past landscapes for the reconstruction of Roman land use: Eco-history tourism in the Algarve, 23 p.
2009-51	Eveline van Leeuwen Peter Nijkamp Teresa de Noronha Vaz	The Multi-functional use of urban green space, 12 p.
2009-52	Peter Bakker Carl Koopmans Peter Nijkamp	Appraisal of integrated transport policies, 20 p.
2009-53	Luca De Angelis Leonard J. Paas	The dynamics analysis and prediction of stock markets through the latent Markov model, 29 p.
2009-54	Jan Anne Annema Carl Koopmans	Een lastige praktijk: Ervaringen met waarderen van omgevingskwaliteit in de kosten-batenanalyse, 17 p.
2009-55	Bas Straathof Gert-Jan Linders	Europe's internal market at fifty: Over the hill? 39 p.
2009-56	Joaquim A.S. Gromicho Jelke J. van Hoorn Francisco Saldanha-da-Gama Gerrit T. Timmer	Exponentially better than brute force: solving the job-shop scheduling problem optimally by dynamic programming, 14 p.
2009-57	Carmen Lee Roman Kraeussl Leo Paas	The effect of anticipated and experienced regret and pride on investors' future selling decisions, 31 p.
2009-58	René Sitters	Efficient algorithms for average completion time scheduling, 17 p.

2009-59

Masood Gheasi
Peter Nijkamp
Piet Rietveld

Migration and tourist flows, 20 p.

2010-1	Roberto Patuelli Norbert Schanne Daniel A. Griffith Peter Nijkamp	Persistent disparities in regional unemployment: Application of a spatial filtering approach to local labour markets in Germany, 28 p.
2010-2	Thomas de Graaff Ghebre Debrezion Piet Rietveld	Schaalsprong Almere. Het effect van bereikbaarheidsverbeteringen op de huizenprijzen in Almere, 22 p.
2010-3	John Steenbruggen Maria Teresa Borzacchiello Peter Nijkamp Henk Scholten	Real-time data from mobile phone networks for urban incidence and traffic management – a review of application and opportunities, 23 p.
2010-4	Marc D. Bahlmann Tom Elfring Peter Groenewegen Marleen H. Huysman	Does distance matter? An ego-network approach towards the knowledge-based theory of clusters, 31 p.
2010-5	Jelke J. van Hoorn	A note on the worst case complexity for the capacitated vehicle routing problem, 3 p.
2010-6	Mark G. Lijesen	Empirical applications of spatial competition; an interpretative literature review, 16 p.
2010-7	Carmen Lee Roman Kraeussl Leo Paas	Personality and investment: Personality differences affect investors' adaptation to losses, 28 p.
2010-8	Nahom Ghebrihiwet Evgenia Motchenkova	Leniency programs in the presence of judicial errors, 21 p.
2010-9	Meindert J. Flikkema Ard-Pieter de Man Matthijs Wolters	New trademark registration as an indicator of innovation: results of an explorative study of Benelux trademark data, 53 p.
2010-10	Jani Merikivi Tibert Verhagen Frans Feldberg	Having belief(s) in social virtual worlds: A decomposed approach, 37 p.